DOCUMENT RESUME

ED 025 718 AC 003 623

By-Cohen, David M.; Dubin, Samuel S.

A Systems Approach to Updating Professional Personnel.

Pub Date Feb 69

Note-12p.; Paper presented at the National Seminar on Adult Education Research (Toronto, February 9-11, 1969)

EDRS Price MF-$0.25 HC-$0.70

Descriptors-*Evaluation, *Models, *Professional Continuing Education, Research, *Systems Approach

Professional updating processes can be visualized as a system enabling both educators and professionals to enhance individual competence. The systems analysis model given here represents updating practices both pictorially and mathematically. Strengths of the model are: it incorporates educational, psychological, and motivational factors from a systems viewpoint; the mathematical model enables the determination of the most influential variables in the updating process; the model can be developed for both individuals and groups; and parameters of mathematical models can be estimated or determined with standard statistical procedures. Weaknesses are: the model is somewhat simplified and may not include all possible parameters; negative feedback is not recognized; the problem of statistical estimation of parameters is still unresolved; and the assumption that updating is a consistently nondecreasing process can be questioned. (Seven figures are included.) (ly)

ABSTRACT

A SYSTEMS APPROACH TO UPDATING PROFESSIONAL PERSONNEL

David M. Cohen, M.S. & Samuel S. Dubin, Ph.D.
Continuing Education
The Pennsylvania State University

Technologies have accelerated and advanced so rapidly that demands for the dissemination of newly developed knowledge and increased competence in professional fields has become increasingly important. The objective of this paper is to describe the updating process from a totally fresh viewpoint.

The professional updating process can be visualized as a system which enables both the educator and professional to deal with relevant factors to promote more effective individual competence. The system represents the updating practices mathematically and takes cognizance of the many psychological factors involved in updating. The mathematical model provides a basis for using it as a decision-making tool for continuing education programs.

A SYSTEMS APPROACH TO UPDATING PROFESSIONALS

David M. Cohen, M.S.
Samuel S. Dubin, Ph.D.
Continuing Education
The Pennsylvania State University

Introduction

Our rapidly changing technical society has amassed much new knowledge. An urgent need exists for disseminating this information to assist professional persons to maintain competence in their fields.

The objective of this paper is to describe the updating process from a totally fresh viewpoint. It visualizes the professional updating process as a whole rather than its individual constituents. A main advantage of this approach is that it enables both the educator and the professional to deal with the relevant components which promote more effective professional growth and development. In doing so, this system takes cognizance of the educational environment and psychological factors involved in updating which can be described in a mathematical equation.

Hypothesis

Professional updating can be simulated as a feedback control system by utilizing a mathematical model which incorporates the educational environment, psychological and motivational factors.

Presented at the National Seminar on Adult Education, Toronto, Canada, February 1969

The Systems Concept

A system is a group of units so combined as to form an organized whole which operates in unison. This provides a framework for visualizing internal and external environmental factors as an integrated function. Such a complex system can be composed of many subsystems: each system has inputs and outputs. Inputs can be defined as influences which originate outside the system. They act on the system externally and do not directly affect the internal relationships. The changes in the state of the system which result from the action of external influences, or inputs, are called the outputs of the system. A system approach to a problem attempts to consider the relevant factors which enable better observation and understanding of the empirical physical world.

(A)

An equation is also a representation of a system. For example: $Y = 2X$ represents a linearly related system between the independent variable X and dependent variable Y. This equation can also be represented as an input-output model. This is shown in Figure 1A.

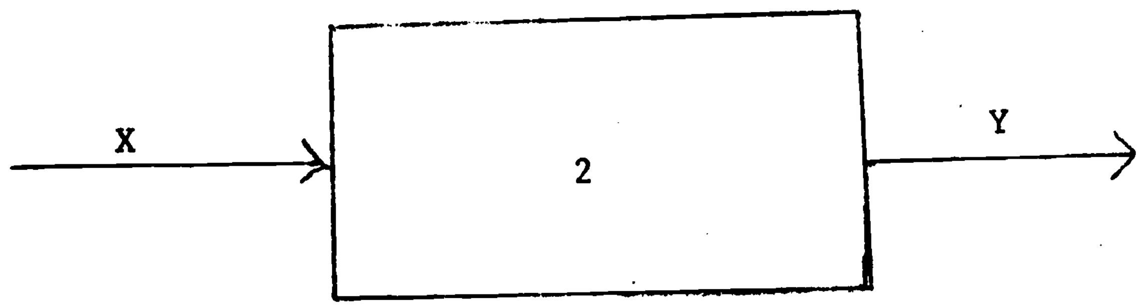


Figure 1A

Here the inputs to the system are the various values of X which are being operated on by 2; this results in outputs of the system Y. Such a system or equation can be visualized graphically as in Figure 1B.

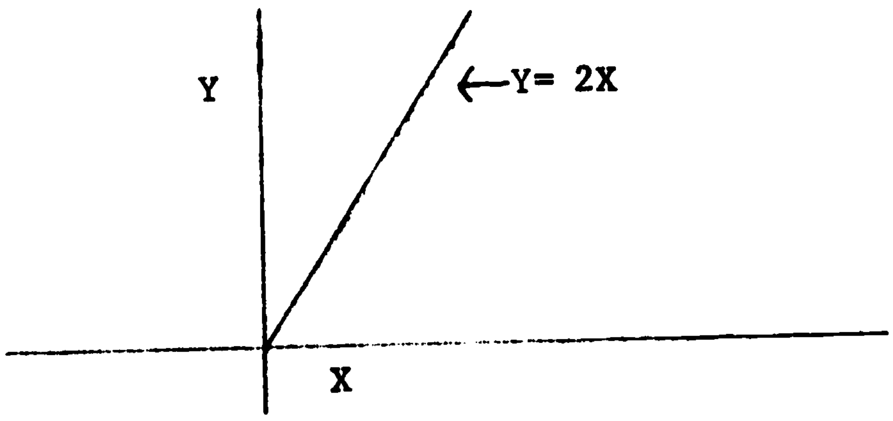


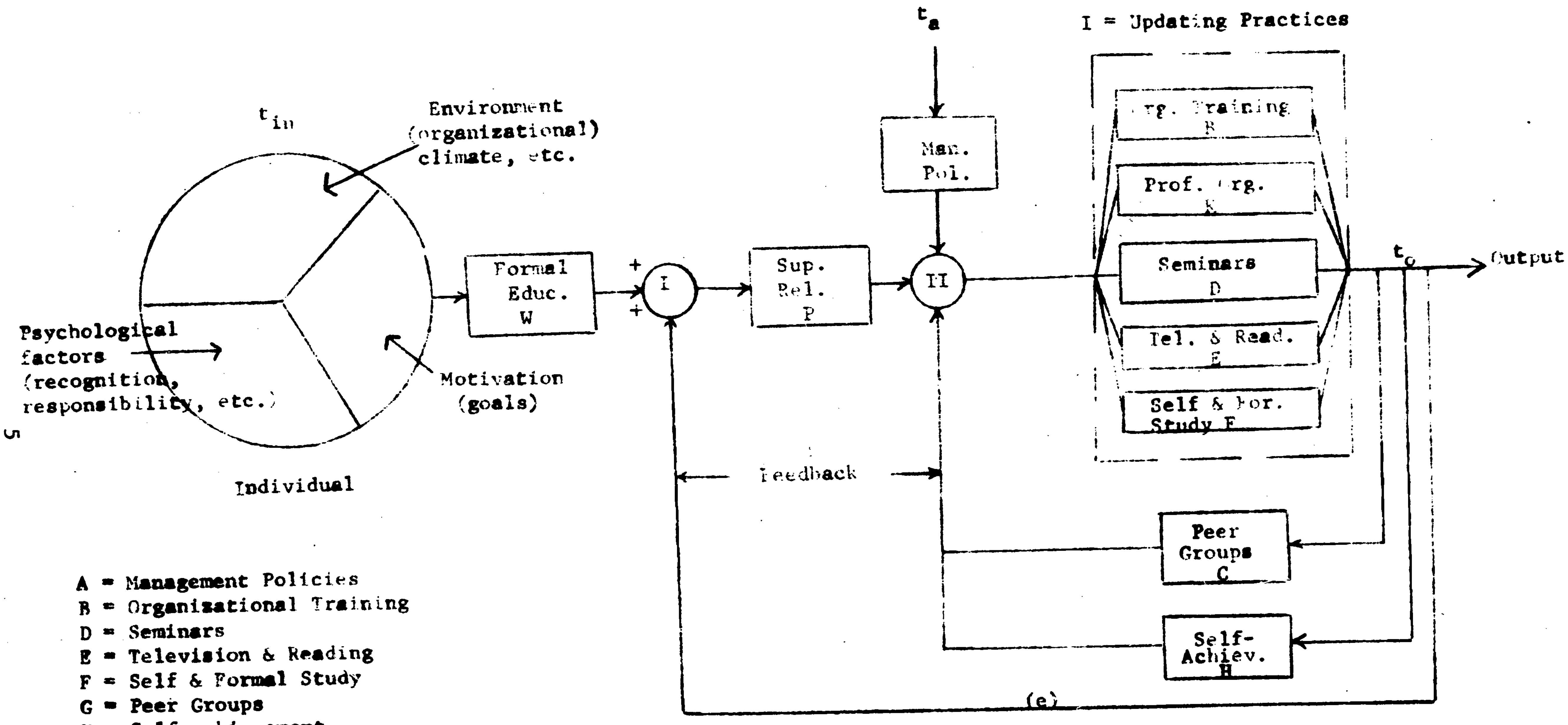
Figure 1B

Therefore such a representation makes it easy to visualize or quantify any of the relationships which compose the system.

A Systems Model for Updating

A systems approach to professional updating is proposed in Figure 2. The purpose of such a representation is to visualize the multiple factors which could enhance the updating process. Because of this, only positive feedbacks occur in the professional updating system. If for example, there were negative effects (such as human resistance, lack of cooperation, negativism) in the updating process, the system reflects this as being a zero factor since nothing has been added to the updating process. Thus, the system only reflects positive factors which increase professional updating.

In Figure 2, the input to this system is the individual. Professional updating involves such factors as environment, psychological factors and motivation. Box W in the system represents the past formal education of the professional. Continuing into the main system, box P represents the effects of supervision on possible updating. Next is box A and t_a, which



A = Management Policies
B = Organizational Training
D = Seminars
E = Television & Reading
F = Self & Formal Study
G = Peer Groups
H = Self-achievement
K = Professional Organization
P = Supervision Relationships
W = Formal Education

A MODEL FOR PROFESSIONAL UPDATING

Figure 2

are outside influences of the system caused by management policies. Box $I = B + K + D + E + F$ represents various approaches to updating practices which a professional can undergo. In this case, a professional can go through any combination of I simultaneously or one at a time. Boxes G and H represent the positive effects of peer groups and/or self achievement as a result of the updating process. This is shown as feedback in this system. If no positive feedback occurs due to peer groups and/or self achievement, the system can have a cycling effect back to the main system via the third feedback loop (e). Finally, the output of this system is either an updated or non-updated individual. Negative updating cannot occur in this system.

Mathematical Representation of Updating

The mathematical equation of a professional updating system is shown in Figure 2. This equation states that the updating professional is the result of many factors: past formal education, the effects of supervisory behavior, actuation of managerial policies which stimulate learning, peer group interaction and the extent of self-achievement. Starting with summation point I, in Figure 2, it can be seen that $(t_{in}W + t_o)$ is multiplied by P. Summation point II, $(t_{in}W + t_o)\,P + t_aA + t_o\,(G + H)$ is multiplied by $I = B + K + D + E + F$. This quantity is equal to t_o (the output).

The following is the mathematical representation of the professional updating system as described in Figure 2:

$$[(t_{in}W + t_o)\ P + t_aA + t_o\ (G + H)]\ I = t_o$$

Where $I = B + K + D + E + F$

Solving for t_o:

$$t_o = \frac{I(WP\ t_{in} + t_aA)}{1 - I(G + H + P)} \quad \text{--- Equation (1)}$$

t_o = updated individual (output of system)

t_{in} = individual coming into system (input)

W = formal education

P = supervision relationships

A = management policies

G = peer groups

H = self-achievement

t_a = actuation of management policies

I = updating practices $(B + K + D + E + F)$

Using equation 1 the effects of the several parameters in the system can be analyzed. For example, if it is desired to know the effects of I (the updating process of the system) while holding all other factors constant, equation 1 becomes:

$$t_o = \frac{C_1X}{1 - C_2X}$$

Where C_1 and C_2 = constants

X = variations due to I

As can be seen in Figure 3, if X increases, the output t_o increases.

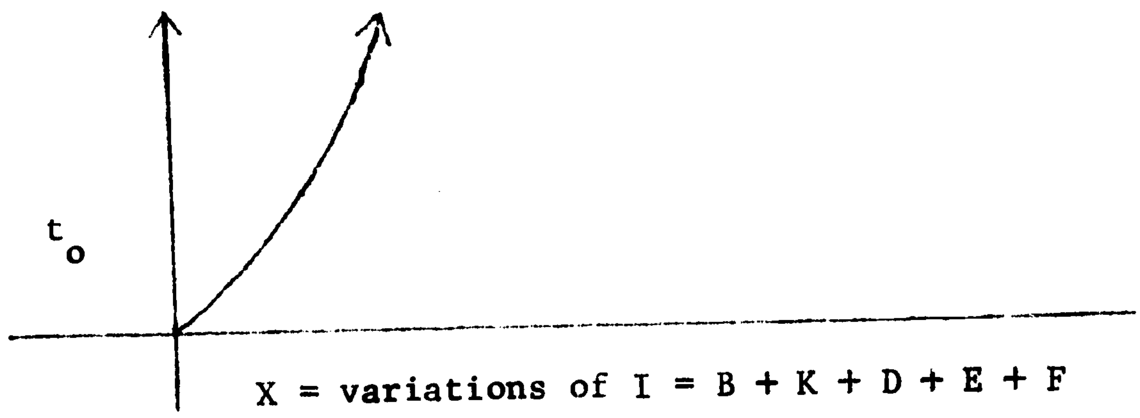


Figure 3

Another example is varying the effect of management policies (t_aA) while holding the rest of the system constant. Equation 1 now takes on the form:

$$t_o = \frac{C_3 + X}{C_4}$$

Where C_3 and C_4 = constants

X = variations due to management policies

Here again, if X increases in value, the output of this system increases. The result is demonstrated in Figure 4.

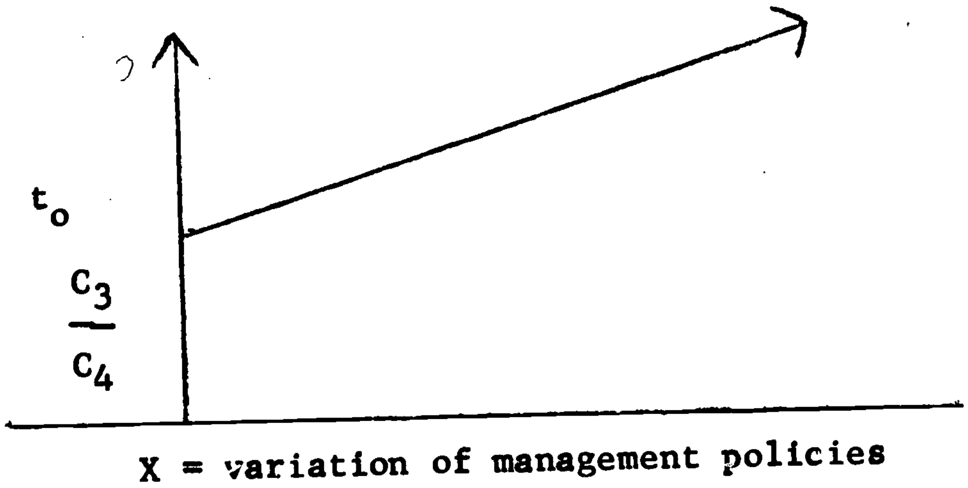


Figure 4

The effect of the feedback of the system, or in other words, peer groups and individual self-achievement can be demonstrated. Again all other

elements in the system are being held constant and equation 1 has the form:

$$t_o = \frac{C_5}{1 - C_6X}$$

Where C_5 and C_6 = constants

X = variations due to peer groups and self-achievement

Likewise if X increases in value, the output of the system increases. The result is shown in Figure 5.

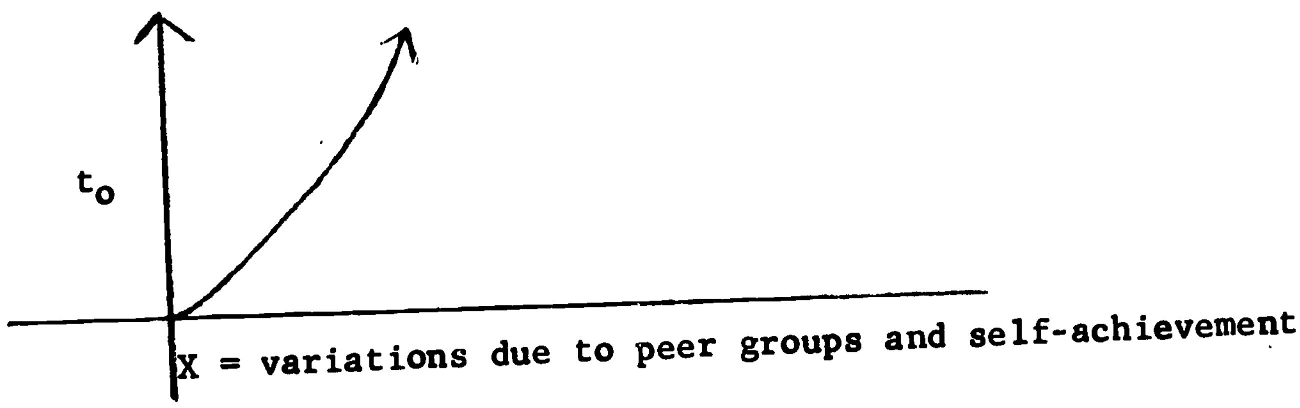


Figure 5

Finally the last example shows how the individual input (t_{in}) to the system affects the output. Again, all other elements of the system are held constant and equation 1 takes the form:

$$t_o = \frac{C_7X + C_8}{C_9}$$

Where C_7 and C_8 and C_9 = constants

X = variations due to input

Again, it can be seen that an increase in X causes an increase in output t_o. This is shown in Figure 6.

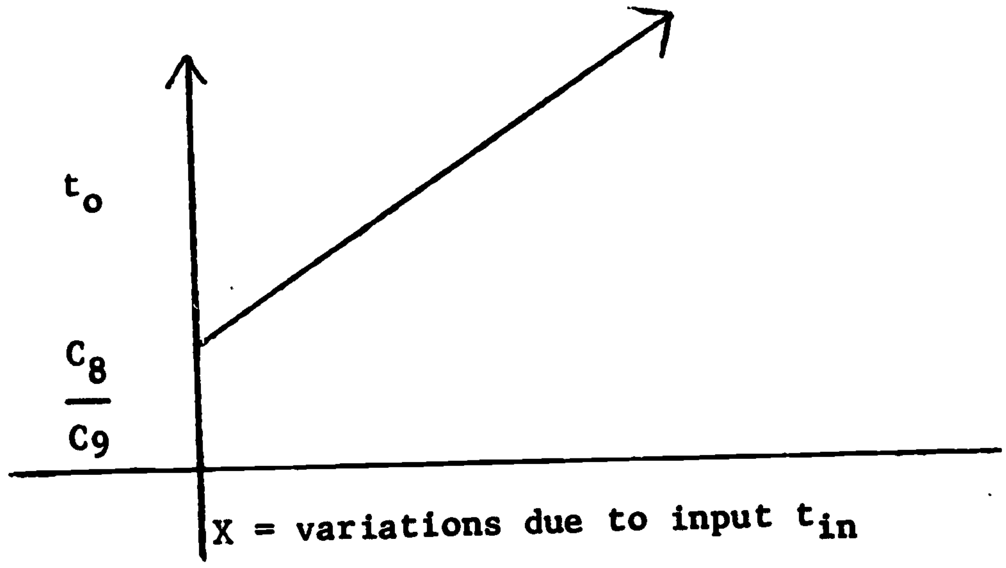


Figure 6

Figures 3 through 6, show that equation 1 is a monotonically-nondecreasing function. Also, Figures 3 through 6 demonstrate how each parameter of the system affects the updating process as well as the parameters most sensitive to change. This is defined as change in output. Figures 3 and 6 seem to reflect the parameters which could be most sensitive to the updating process.

Also,, any combination of variables can be graphed, such as management policies (t_a) and updating practices (I), while holding the rest of the system constant. Equation 1 now has the form:

$$t_o = \frac{X(C_{10} + AY)}{(1 - XC_{11})}$$

Where C_{10} and C_{11} = constants

Y = variations due to management policies

X = variations due to updating policies

This equation could have the form as follows:

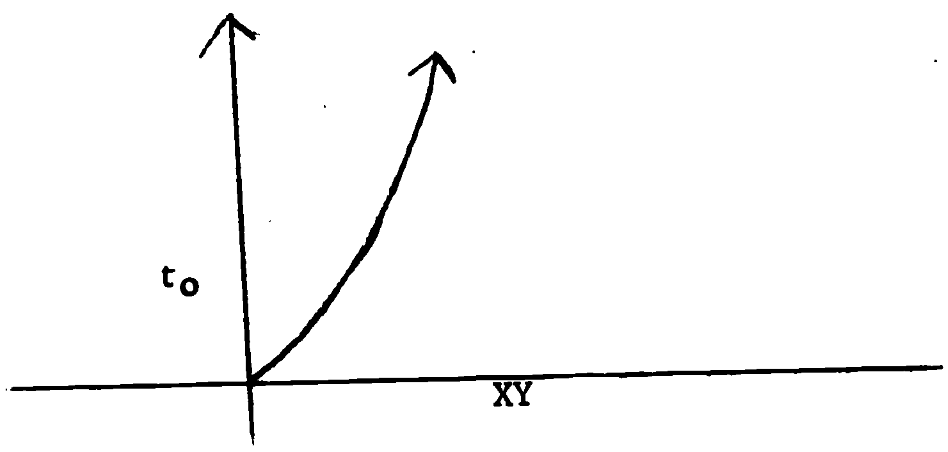


Figure 7

Strengths and Weaknesses of Model

A. The Strengths of the Model are:

1. The model incorporates educational, environmental, psychological and motivational factors from a systems viewpoint.

2. The mathematical model enables continuing education to determine which variables are most influential in the updating process thereby making the model usable as a decision-making tool.

3. This model can be developed both for individuals and for groups of professionals.

4. The parameters of the mathematical model can be estimated or determined by use of standard statistical procedures. This will tend to provide optimum conditions for decision making.

B. The Weaknesses of the Model are:

1. The model is somewhat simplified and may not include all possible updating parameters.

2. The model does not recognize any negative feedbacks.

3. The problem of statistical estimation of the parameters of the model has not yet been resolved: this represents a challenging effort.

4. The assumption that updating is a monotonically non-decreasing process can be questioned.

Application of Model

Having derived a mathematical model of professional updating, the next procedure is how this model can be applied. The relationships which comprise the model have to be derived from data obtained from field studies or past experimentation. Having determined the relationships between the parameters the next step is to test the model for validity. This can be done by experimentation in a professional field. In doing so, the range and average updating can be determined. Also, this model can reflect which variable or variables seem to influence the updating process most significantly. After determining a valid model, the parameters which are most sensitive to the updating process can help determine the role and policies of continuing education by universities. Thus it can be used as a decision-making device for continuing education.

Conclusion

In conclusion, this system reflects the relationships that are developed in a complex updating process not only in pictorial system, but as a mathematical procedure for measuring professional updating. Therefore, this process can be viewed both as a total system and as an individual process. Consequently, this system provides a means for the updating processes in conjunction with the psychological environmental effects.